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The decay and energy distribution of unstable bound states

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Abstract

An approach to the theory of unstable bound states of electrons in the nuclear field is suggested. This approach permits the determination of unstable bound states when a quasistationary approximation is unjustified and, therefore, methods normally used for this purpose in the atomic theory cannot be applied. The equations employed in the author's approach make it possible, without resorting to perturbation theory, to determine the energy distribution of excited states, the shape of the natural broadening of spectral lines, the amplitudes of the resonance scattering of photons and electrons over atomic systems, and to describe spontaneous radiation and autoionisation decay. Calculated results are given of the shape of the natural broadening of spectral lines in a three-level atomic system when energy levels overlap. In the quasistationary approximation standard expressions of the relativistic atomic theory for level energy shifts and radiation widths follow from the equations.

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